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Comments: *From the SCS Chief*

We Can Cut Flood Losses

Every year, floods damage more and more property, crops, and important wildlife habitat—especially in upstream areas.

The Soil Conservation Service and conservation districts can help solve these problems. And help we must. Flood prevention is one of our highest priorities today.

Landowners themselves can reduce potential flood damages quite a bit. But they need information on what to do, and they need community support.

SCS and districts can determine where the flood hazards are, and how severe they are. We can develop public information materials and campaigns. We can recruit and train volunteers. We can cooperate with other Federal and State agencies on ways to reduce flood damages, and ways to streamline the planning and review of project activities. We can help communities design warning and flood emergency support systems.

Finally, we can help blend all these efforts into overall action plans that work. What we need is to help many more communities and individuals learn about flood hazards and do something about them.

USDA Earmarks $10 Million for Emergency Flood Relief

Secretary of Agriculture John R. Block earmarked $10 million to meet extraordinary flood emergency conditions in the hard-hit areas of West Virginia and Virginia, where flood emergency damage reached record proportions.

Secretary Block, using an emergency program administered by USDA's Soil Conservation Service, directed the agency to cooperate with other Federal and State agencies and use $6 million in West Virginia and $4 million in Virginia to open water courses that were plugged with sediment and debris as the result of massive flooding caused by torrential rains in early November.

Severe stream blockage and flood flows caused streams to overflow into homes, businesses, and highways. Repairs will be made to restore stream channels, dikes, levees, and other flood retarding works which suffered extensive damage. The situation constitutes an immediate threat to life and property.

Conditions are such that streams and flood control structures cannot handle new flood waters, nor can communities begin to function again without extensive restoration work.

Block said the assistance will come from watershed construction funds for use under the continuing resolution for fiscal year 1986.

Cover: Melting snow, one of the major sources of water in the West. The Soil Conservation Service is giving reservoir operators individualized operating guides to help them control water levels in their reservoirs. See article on pages 10–11. (Hyalite Creek, Montana. Photo by Phil Farnes, supervisor of the SCS Snow Survey Program for Montana.)

John R. Block
Secretary of Agriculture

Wilson Scaling, Chief
Soil Conservation Service

All programs of the U.S. Department of Agriculture are available to everyone without regard to race, creed, color, sex, age, or national origin.

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Range Conference Promotes Spirit of Cooperation

Calling rangeland "America's forgotten resource," Deputy Secretary of Agriculture John R. Norton presented the keynote address at the National Range Conference, November 6 through 8, 1985. Norton set the stage for the nearly 600 ranchers, educators, and Government officials who met in Oklahoma City, Okla., for the 3 days of active discussion. He emphasized that all Americans have a stake in protecting the Nation's range resources.

Norton said, "The major use of rangeland surely will continue to be forage for livestock. But new opportunities increasingly will arise in a growing economy to use this resource in other, less traditional ways." He challenged the group to make range research, and its practical application on the range, "as dynamic as the basic resource itself."

Another challenge we face, according to Norton, is "what to do with land that may be committed to a conservation reserve under the new farm bill" and what should be done to ensure this land stays out of production after the conservation reserve contract expires.

Several recurring messages emerged from the sessions that followed Norton's speech:

- Rangeland, occupying more than a billion acres of the United States and supporting the livelihood of millions of families, is important to the Nation's future.
- There are a number of valuable and useful products from range, and several environmental and esthetic values. Use of rangeland will become more diversified in the future.
- Forage for livestock will continue to be the primary use, but other uses—such as wildlife, recreation, and crops for industrial, energy, or food purposes—will be economically desirable for the landowner, public land manager, and the community.
- Strengthened research programs are needed, along with more practical and timely application of the research findings, in order to help landowners, land managers, and others make informed choices on livestock and plant varieties, treatment options, marketing strategies, and assistance needs.
- Range issues cannot be addressed by themselves; they need to be blended with other economic, social, and environmental questions in order to achieve range strategies that are timely, cost-effective, and fair.
- There is potential for conflict among all the uses of range or interests in range, but such conflicts can be minimized or resolved if the parties involved work hard at learning each other's points of view and at helping each other increase public understanding of the many values and needs of rangelands, and if they are open to modifying their own objectives or practices.
- Tax policies, trade policies, and a number of other factors outside the agricultural sector influence the use and condition of range. The likely future demands on range and its likelihood of being able to meet those demands need to be addressed as well.

Another major speaker at the conference, Secretary of the Interior Donald P. Hodel, spoke of his Department's interest in rangeland including protecting wilderness and parks, improving our Nation's ability to meet its mineral and energy requirements, protecting recreation and heritage resources, and helping to manage Indian affairs.

He said that in addition to management responsibilities for public lands, "we have lease arrangements with thousands of ranchers, and we have relationships with millions of Americans in the hiking, fishing, and camping crowd. All of these multiple uses and multiple interests can be compatible."

He spoke of U.S. Department of the Interior (USDI) staffs being encouraged to be "good neighbors," and he pointed to increased cooperation between the Bureau of Land Management and USDA's Forest Service.

Hodel mentioned Coordinated Resource Management Planning and a working partnership between public and private sectors. He outlined a new USDI public awareness campaign—Take Pride in America—to encourage all Americans to recognize their stewardship responsibilities for public lands.

He called on conference participants to "encourage more of our fellow Americans to work together to improve the resource base, to set aside conflicts that are causing us difficulty, and to establish some consensus."

The National Range Conference was sponsored by more than 60 commodity, conservation, and public-interest groups along with the Council on Environmental Quality, the U.S. Environmental Protection Agency, the U.S. Department of Agriculture, and the U.S. Department of the Interior. Papers presented at the conference will be available in a proceedings to be published within the next few months.

For more information, contact Doug Sellars, Conference Coordinator, Soil Conservation Service, P.O. Box 2890, Washington, DC 20013–2890 or telephone (202) 382–1858.

News Briefs

Intensive Grazing System Introduced in Northeast

A field review of rotational grazing and fencing methods, perfected in New Zealand and gaining attention in the Northeast through its recent introduction in Vermont, attracted more than 60 agronomists and soils specialists from 13 Northeast States. Sponsored by the University of Vermont's Extension Service and the Soil Conservation Service, the review held last July consisted of onfarm presentations by six farmers in Chittenden and Franklin Counties who are employing the Voisin intensive rotational grazing system on their dairy and sheep operations.

Begun in Europe by Andre Voisin, a French farmer and biochemist, the system offers distinct advantages over conventional grazing techniques. It is applicable to Northeast conditions with cool season grasses.

Through the use of lightweight moveable fencing, traditional continuous pastures are divided into 10 paddocks or more. Livestock intensively graze the first paddock and then are rotated through the remaining paddocks, allowing even-aged regrowth of the plant materials in the first paddock by the time the livestock are rotated back.

Short grazing periods and frequent rest periods increase plant vigor and result in fast regrowth of grass and clover. By mob-stocking each paddock selective grazing is virtually eliminated. Unproductive bushy growth is curtailed and even regrowth occurs at maximum production instead of allowing some areas to become mature while other patches are overgrazed by continual grazing before regrowth. The grazing efficiently recycles nutrients in the animals' manure and keeps these nutrients available to plants. And in times of rapid pasture growth, the surplus can be cut for hay, haylage, or silage. The Voisin system is also an ideal way to bring marginal land or neglected pastures into production without costly pasture renovation or reseeding.

Vermont's SCS Agronomist Frank Webb (left) and State Resource Conservationist Rick Heaslip examine portable fencing used with the Voisin intensive grazing system.

Other testimony by the farmers on the Voisin system's worth gave credence to additional benefits. Besides higher quality forage, higher protein content, fewer weeds, and increased forage production, other attributes include an extended grazing season, reduced labor and production costs, reduced pasture damage, inexpensive startup costs, and increased profits.

With proper guidelines, the Voisin system promises to be a boon for farmers just getting started with limited cash flow. This intensive rotational grazing system requires no harvesting equipment, except for haying or ensiling equipment if excess forage is saved; no manure handling; and no storage facility during the growing season. And livestock suffer fewer medical problems associated with confinement and concrete.

As one convinced dairy farmer on the tour's agenda said, "The agriculture industry being what it is, we're under the gun like everybody else. We've concluded that raising our own feed just isn't profitable. We just might sell our machinery in the fall, buy hay in winter, and live it up in the summer."

While this system is relatively new in this country and can't be expected to solve all the financial and management problems of today's farmers, it does seem to have considerable merit in cutting costs and labor.

Ann H. Dudas,
public affairs specialist, SCS, Winooski, Vt.

Iowa Field Office Calls for Volunteers to Complete Field Work

One reason volunteers are so important in conservation is that they're usually there when they're needed the most. Just ask Jack Storkamp, district conservationist for the Soil Conservation Service in Winneshiek County, Iowa.

You've heard of people working themselves out of a job. Well, it didn't happen that way with Storkamp and his staff. The more they worked, the more work they had to do, until finally they couldn't do the work they had to do because of the work they had done.

Winneshiek County is in rural northeast Iowa where there are a lot of dairy farms. Most of the farmers grow corn and a hay crop, usually alfalfa.

About 2 years ago, after determining that soil erosion posed a serious threat to the county, SCS targeted the county for intensive erosion-control work and assigned Storkamp two full-time soil conservationists. The new soil conservationists were to help Storkamp and his two technicians draw up conservation plans for farmers and help the farmers apply the practices called for in the plans.

The extra personnel paid off. During the first year, 1984, Storkamp and his staff, working through the Winneshiek County Soil Conservation District, helped county farmers to apply contour farming and stripcropping on about 2,300 acres. By the spring of 1985 about 5,200 acres had been scheduled for either contour farming or contour stripcropping. The requests for contour stripcropping alone went from 600 acres in 1984 to 2,400 acres in 1985.

"We got excellent response from the farmers," Storkamp said. "We got such good response that by 1985 we weren't sure we could handle it all."

Contour farming and stripcropping both require SCS workers to lay out the fields with marks for the farmers to follow as they go around the slope with their equipment. A crew of two can mark about 180 acres a day for contouring. The same crew can lay out about 40 to 60 acres of strips a day, depending on the contour and condition of the land.

The problem was that there are only a few weeks when the fields are dry enough to walk in before planting time in mid-May. How were Storkamp and his staff going to lay out 5,200 acres?

Realizing he needed help, Storkamp put out a call for volunteers through the local newspaper and other channels. He requested help from anyone capable of walking through corn stubble and holding a hand level. All he could promise were a lot of exercise, fresh air, and a good feeling for helping to conserve the soil.

Storkamp wasn't disappointed. In all, six persons from the town of Decorah and the surrounding areas stepped forward. One was a recent school graduate who, being unemployed, worked with the field crews as needed until all of the acreage was laid out. The others worked a day at a time as their schedules allowed.

"We gave them a little training and immediately put them in the field," Storkamp said. "This gave us three full-time crews and enabled us to get the job done. Not only did we plan more conservation than ever before, we put more conservation on the ground. Without the volunteers, I don't think we could have met our commitments. It's really that simple."

Conservation Grows on the Pacific Islands

Farmers and ranchers in the Mariana Islands are among the first to see America's day begin, and they are among the most recent to join the conservation district effort to care for the Nation's resource needs. Five Pacific island soil and water conservation districts are now organized in this westernmost part of the United States. Bounded by the Pacific Ocean and the Philippine Sea, the Mariana Islands, including the Territory of Guam, are a chain of 15 islands located north of the equator beginning at the 13th parallel.

Since the end of World War II, tourism and a rapidly developing economy have made significant changes in island life. Family farming is no longer the primary occupation. Farms have become businesses. Farmers' search for improved productivity has brought them to agricultural modernization. They recognize their needs for water development and conservation and are aware of the importance of soil erosion control.

Farms are small—most are 1 to 5 acres. Tropical agriculture varies from agroforestry on steep slopes to small row crop plantings and orchards. Much of the food consumed on the islands is imported. Conservation farming could help turn around this dependence on imported food as farmers aim for greater sufficiency in adapted crops and hope to develop an export market. Consequently, soil and water conservation districts have an important role to fill as board members aggressively pursue district objectives.

District legislation for the Commonwealth of the Northern Marianas was passed in 1985, joining that of Guam's, enacted in 1984. Although the system of conservation districts is unfamiliar to island people, the concept of stewardship is one which is well rooted in the traditions of past agrarian subsistence societies.

The legislation that emerged from several months of intense planning sessions is specific to the conditions and needs of the islands' people. Mickey LeonGuerrero, of the Guam Planning Bureau, and a legislative assistant worked with the Soil Conservation Service staff to modify the conservation districts model law. The democratic legislative process in Guam and the Commonwealth is typically lengthy and complex. It is a tribute to the purposes of the program and the vision of the legislators that the laws emerged in viable form.

In Guam, two districts were formed. They reflect the very different topographic and soil characteristics between the northern and southern parts of the island. Northern Guam is a raised plateau. The conservation problems in the north come from wind damage and shallow soils. The soils are generally neutral to alkaline and overlie coral limestone. The south is mountainous. There, conservation problems come from steep slopes and flooding rivers. The soils are acidic, derived from volcanic materials.

Each district board is composed of five members who carry the title of director. Meeting places are rotated from village to village within the district to ensure the participation of cooperators throughout the area. The Guam districts already have about 20 cooperators.

In the Commonwealth of the Northern Marianas three district boards have been formed, each having four board members called administrators. Saipan and the northern islands are within one district. The islands of Tinian and Rota have their own districts. Cattle are more important in the Commonwealth than in Guam, and several district administrators are ranchers.

SCS assistance to all five districts is provided from the Guam field office. In providing this assistance, SCS conservationists face unpredictable travel conditions. Island hopping, often by circuitous routes, is part of the conservationists' job, as they travel to determine conservation needs and apply practices on these remote islands.

Conservationists may encounter any of several languages on island farms including Chamorro, English, Tagalog, and Japanese. Nevertheless, workshops have been conducted on basic soils information and the use of SCS soil surveys, and on erosion control for equipment operators. Guam soil and water conservation districts have also developed demonstration fields and tours.

The conservation districts' main challenge will be one of developing broad recognition and support. Budgets are tight in the islands. New programs must compete against older ones for local departmental funding. Farmers, ranchers, and district leaders form a groundswell of strength eager to meet the conservation challenge in this far west corner of America.

Joan B. Perry,
resource conservationist, SCS, Mangilao, Guam

Conserving Water: The Untapped Alternative

Managing the demand for water, instead of constantly trying to meet it, is the only hope for a truly secure and sustainable water future, according to Sandra Postel, senior researcher at Worldwatch Institute, in her recent report, *Conserving Water: The Untapped Alternative*.

Worldwatch Institute is an independent, nonprofit research organization created to analyze and focus attention on global problems. Directed by Lester R. Brown, Worldwatch Institute is funded by private foundations and United Nations organizations. Worldwatch papers are written for a worldwide audience of decisionmakers, scholars, and the general public.

According to Postel, investments in improving efficiency and management yield more usable water per dollar than conventional water projects such as dams and river diversions. These alternative investments enable food production, industrial output, and cities to expand without parallel increases in water demands.

"Worldwide, the efficiency of irrigation systems averages only 37 percent," said Postel. "Much water is lost as it is moved from reservoirs to farmlands and applied to fields. But new technologies and better management can boost efficiencies dramatically, while cutting energy costs and often increasing crop production at the same time."

Postel said one new technology called LEPA—low-energy precision application—is gaining popularity in northwest Texas, where depletion of the Ogallala Aquifer threatens a lucrative farming economy. LEPA can upgrade conventional sprinkler designs from 70 percent efficiency to 95 percent, and typically pays for itself in reduced pumping costs in 5 to 7 years. The LEPA method delivers water closer to the crops through tubes hanging down from sprinkler arms.

"If widely adopted throughout the U.S. High Plains, such improvements could greatly slow depletion of the Ogallala, which supports about a fifth of U.S. irrigated land," said Postel.

In the report Postel said that in the Third World, better management alone could reduce water withdrawals for most canal systems by 10 to 15 percent, allowing new land to be brought under irrigation at a much lower cost than developing new supplies. Raising irrigation efficiency by 10 percent in the Indus region of Pakistan, for example, could provide enough water to irrigate an additional 2 million hectares.

Farmers will not invest in water efficiency, however, unless pricing policies that promote wastefulness are dismantled, said Postel. Many governments heavily subsidize major irrigation projects. But when charged more for water, farmers in Third World and industrial countries invariably use water more efficiently.

Industries have made some impressive gains in water efficiency, according to the study. Recycling rates in the major water-using manufacturing industries in the United States have steadily risen in recent decades, with the paper industry recycling its water 5.3 times, petroleum refineries about 7 times, and chemical product manufacturers about 3 times.

"If major water-using industries reach the recycling levels projected for them for the year 2000, total water withdrawals for U.S. manufacturing—taking into account expected economic growth—will be 45 percent less than they were in 1978," said Postel.

The key has been strict pollution control standards that force industries to treat wastewaters before discharging them to the environment. As the standards get more stringent and treatment costs rise, recycling begins to pay.

"With such incentives, the Swedish pulp and paper industry, for example, halved its water use between the early sixties and late seventies, while doubling production," she said. "Not only are Sweden's rivers and streams much cleaner, but national water use in the mid-seventies was only half the level projected a decade earlier."

Economic incentives can also spur water efficiency in urban areas, many of which face severe physical and financial constraints on increasing water supplies. Comparatively modest investments in conservation enabled Tucson, Ariz., to defer $45 million in capital costs that would otherwise have been needed to expand the city's water supply. Because of its shift from simply meeting water demand to managing it, Tucson's water utility now plans for a per capita level of fresh water use 25 percent lower than in the early seventies, said Postel.

Although there is no ready-made package of conservation measures that will work in every city, successful efforts include some combination of water-saving technologies, economic incentives, regulations, and consumer education. Without these steps, cities in both industrial and developing countries will encounter enormous capital costs and more frequent and severe water shortages.

With proper incentives and institutional reforms, many prospective water crises could disappear, Postel said. In addition to pricing water at its replacement cost, she urges governments to change water rights and laws that are biased against conservation. Where water is drawn from nonrenewable underground supplies, Postel indicated that a tax on ground water pumping would help balance private and social costs, and encourage conservation.

As an example of the innovative approaches needed, the study points to a proposed scheme to supply growing urban demands in southern California with water saved through increased efficiency in a nearby irrigation district.

"Conservation investments appear a cost-effective way to balance supply and demand in southern California, and should be explored elsewhere," said Postel.

Standards can help spur efficiency when the market fails to do so. Several U.S. States now have laws requiring that fixtures installed in new homes, apartments, and offices meet specified water efficiency standards. But this transition could be made more quickly and uniformly if standards were set at the Federal level.

Even modest efficiency standards for toilets, showerheads, faucets, and dishwashers could reduce water use by a volume that would meet the yearly household needs of nearly 10 million people, the study found.

"The transition to a water-efficient economy will not be easy or painless, but it has begun and it should be fostered," Postel concluded.

Copies of *Worldwatch Paper 67, Conserving Water: The Untapped Alternative* are available for $4 each from the Worldwatch Institute, 1776 Massachusetts Avenue, NW., Washington, DC 20036.

SCS Emphasizes Ground Water Training

Researchers have recently identified new threats to the quality of ground water in several parts of the Nation. In response, the Soil Conservation Service is offering an advanced ground water training program to all of its geologists.

SCS currently has more than 70 geologists. The training program, which takes 18 months and is worth 12 graduate semester hours, is designed to bring the geologists abreast of the latest developments in the rapidly changing field of ground water research and technology. It is taught by correspondence by Wright State University in Dayton, Ohio. The first group of geologists completed the program in August 1985.

In other action, SCS has also started a course in the fundamentals of ground water for its soil conservationists, engineers, and people in other technical fields. A more basic course is currently under consideration for SCS managers. This course would provide an understanding of ground water systems, hydrogeochemistry, contamination, exploration techniques, resource management, artificial recharge, legal considerations, and related subjects.

The new emphasis by SCS on ground water training comes at a time of increased public concern over ground water pollution. As of February 1985, according to the U.S. Environmental Protection Agency, pesticides had been found in ground water in 23 States. Six pesticides had been found in ground water in New York and Iowa and five in California and Maryland.

According to estimates, more than 90 percent of rural Americans depend on ground water for all their water needs. Ground water provides about one-fourth of the Nation's total water consumption.

Lou Kirkaldie,
national engineering and ground water geologist, Engineering Division, SCS, Washington, DC

SCS Becomes Computer Connection for Farmers

Jim and Terry Hofer, Waitsburg, Wash., recently used a computer printout from the Soil Conservation Service office in Walla Walla, Wash., to help convince a landlady to let them use conservation tillage on her land. The land had previously been moldboard plowed in a wheat-fallow rotation. But the computer printout showed profit advantages for using chisel tillage instead of plowing.

"Now we have her land on a 3-year rotation of winter wheat, spring barley, and summer-fallow," Jim Hofer says. "My brother and I are also using stripcropping as well as chisel tillage. Some of the slopes on her land are more than halfway to being straight up and down. Some slopes are more than a mile long. With the new cropping plan, however, we can increase farming profits and also do a better job of preventing soil erosion."

The Hofers have been working with the local SCS office on conservation tillage for 6 years. Larry L. Hooker, SCS district conservationist at the Walla Walla office, says many other growers have had experiences similar to the Hofers. They find that computer-run trial budgets help them see the advantages of conservation tillage.

"Our State SCS economist, Larry Edmonds, used to work out similar trial budgets with a desk-top calculator," Hooker recalls. "It took him a couple of weeks to do something we can now do on our office's computer in less than an hour, with Agnet's CROPBUDGET software."

The Walla Walla SCS office had its first experience with Agnet in 1981. But until 1983, Hooker obtained trial budgets by using a keyboard and printer in his office to link up by phone with a mainframe computer at the University of Nebraska. The Walla Walla office now has its own personal computer, and Hooker has programmed it with many of the equations and constant figures from the University of Nebraska computer. This saves the money previously spent on long-distance charges and University of Nebraska computer time.

Besides using Agnet's CROPBUDGET, Hooker uses a much simpler Agnet program called BESTCROP to help growers make decisions about crop rotations. This software package assumes that the grower can come up the necessary machines and manpower for any given crop and tillage proposal, while CROPBUDGET doesn't.

BESTCROP helped Dave Carey, Walla Walla, Wash., to decide between planting spring barley or cannery peas on one field in 1984. "I had a hunch that the barley would produce more net income," Carey recalls. "But I was wrong." Carey and Hooker plugged in Carey's estimate of barley prices at harvest, his costs for fuel and machine time, and his yield predictions. The printout showed that peas would net about 10 percent more per acre than barley. Then the cannery made the decision even easier by raising its offer on contract prices a bit, so Carey signed up to grow cannery peas.

"The cannery people wanted to make some copies of those printouts, too," Carey says.

Carey and the Hofers haven't yet bought their own computers. But the Hofers' accountant and tax consultant does have one. In addition, Jim Hofers' high-school-age son is studying computers and trying to convince Jim to buy one for use in farm accounting and for the son's homework.

Hooker says this kind of exposure to computers has helped growers appreciate the importance of getting more precise farm-account figures.

"The information coming out is only as good as the information supplied by the grower to put into the computer," Hooker adds.

Besides helping Hooker and his associates promote conservation tillage, the SCS computer has made it easier to maintain and update mailing lists for various SCS information programs. The computer also keeps the records needed to properly operate and maintain a fleet of cars and trucks, keeps personnel records, stores farm conservation plans, and so on.

And when enough farmers buy their own personal computers, the SCS computer could someday be pressed into additional service as a computerized bulletin board, Hooker adds. A grower could use his computer to get information out of the SCS computer by telephone modem, making the

SCS office a continuing computer connection for growers.

Other SCS offices across the United States offer computer connections for farmers. They provide services suited to local agriculture and local soil conservation needs. For example, the SCS office in Prosser, Wash., offers irrigation design assistance. The Jackson, Tenn., office offers grassland and cropland planning assistance, and so on. Many more area SCS offices will also enter the computer age in the near future. They'll build on the experiences of SCS computer pioneers.

Steve McGill,
regional editor, *The Furrow.*

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Automated Flood Warning System Nears Completion

Progress continues on Connecticut's automated flood warning system. (See article on pages 3-5 in the January 1985 issue of *Soil and Water Conservation News.)*

The system provides instantaneous rainfall and streamflow heights to a computer system network which can estimate what the flood stage will be and how long it will take to reach that stage. The system, when tied to the local civil emergency preparedness network, gives property owners time to take action before floods hit, greatly reducing flood damages.

By the end of October 1985, work was nearly complete on the statewide system of 21 automated precipitation gauges and the two local systems of three gauges each. The cylinders for housing the electronics and antennae had been installed and the disturbed area around them had been smoothed and seeded. The tubular housing for the gauges is armor plated to protect the equipment from vandalism, and a storage system for antifreeze protects it from freezing. A locking door was installed on each gauge to make it easy to maintain the equipment and still keep it secure.

All 27 gauges began sending radio signals in December to the National Weather Service's River Forecast Center in Bloomfield and the Connecticut Department of Environmental Protection (DEP) in Hartford.

In November, the two pilot communities of Southington and Norwich were involved in purchasing and installing computer hardware to receive and interpret radio signals from the precipitation gauges in their watersheds.

DEP's Forestry Unit will be monitoring data from six of the precipitation gauges that are equipped to also measure wind speed, wind direction, soil moisture, air temperature, and relative humidity. The Forestry Unit will use the information to evaluate the potential for forest fires. DEP provided about $3,000 to equip the gauges to collect the additional data.

Interviews with property owners in Norwich are complete and lists of actions that residents can take to protect their property at various flood stages have been prepared. Interviews and individual action plans for property owners in both Norwich and Southington and community emergency action plans are scheduled to be completed by September 1986.

Phil Renn, Soil Conservation Service water resources coordinator in Connecticut, said that the statewide system of gauges; the computer hardware at the River Forecast Center, DEP, and the two pilot communities; and individual and community action plans for reducing flood damages should all be ready by September 1986. Renn said it will probably take a few storm events for people to become accustomed to receiving the data and using it to tell residents how to respond.

SCS State conservationist in Connecticut, Philip Christensen, said that the primary purpose of the automated flood warning system is to reduce flood damages, but an added benefit is the increased public awareness of the proper use of floodplains. Christensen expects this awareness will prompt communities to stop any further development of floodplains.

Nancy M. Garlitz,
associate editor, *Soil and Water Conservation News,* SCS, Washington, DC

Mountain Springs: A Source of Irrigation Water and Energy

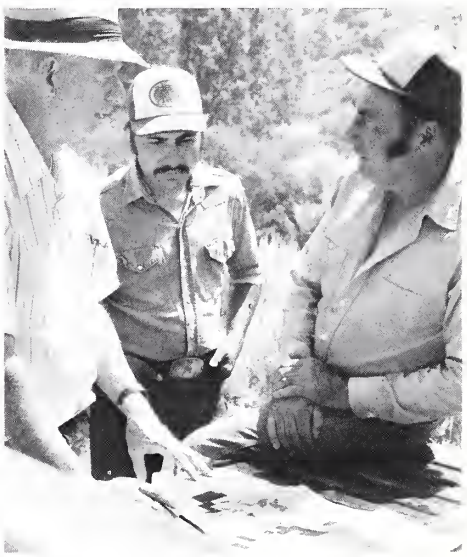
A ranch family in western Nevada is capitalizing on a strong natural force—gravity. Gravity pulls the water through their irrigation systems, and gravity will also soon light their houses and run their appliances.

Herb Capurro operates the Big Canyon Ranch near Pyramid Lake with his brother George, nephew Allen, and sons. They use the mountain springs fed by snowmelt high in the Virginia Mountains not only to water their crops but soon to also generate electricity.

The Big Canyon Ranch covers 2,600 acres scattered among 30,000 acres of public land that is administered by the U.S. Department of the Interior's Bureau of Land Management (BLM). The Capurros run about 400 head of cattle on it under a BLM permit and are following a coordinated resource management plan.

The Capurros irrigate about 200 acres of alfalfa, orchardgrass, and native meadow grasses for hay scattered among 20 to 25 different fields. The Capurros sprinkle irrigate about two-thirds of the cropland and flood irrigate the rest. Both the sprinkler and flood irrigation systems are run entirely on gravity pressure.

Four buried pipelines, which begin 5,500 feet above sea level, carry snowmelt and spring water from the 8,000-foot-high Tule Ridge on the west side of the ranch. The water flows 2 miles to the Capurros' fields. The water flows free for about the first mile



before entering pipelines. Unused water eventually runs into Big Canyon Creek below the ranch and into the 115,000-acre Pyramid Lake, habitat of the Lahontan cutthroat trout.

The Capurros are cooperators with the Washoe–Storey Conservation District. The Soil Conservation Service has been working with the Capurros for 20 years. SCS has helped redesign their irrigation system and design the pipelines. The pipes are sized to deliver water in sufficient volume and pressure. The fall on most of the lines is 8 to 10 percent and as low as 4 percent on flatter fields.

SCS District Conservationist Richard MacDougall in Reno, Nev., said that the Capurros have been gradually replacing the original pipe installed in the 1940's with plastic pipe. In the higher areas they are also increasing the diameter of the pipe from 2 inches to 4 inches.

The Agricultural Stabilization and Conservation Service has provided cost sharing through the Agricultural Conservation Program.

One of the Capurros' objectives in redesigning the irrigation system is to move from a combination of sprinkler and flood irrigation to a more efficient all sprinkler system. They are getting about 55 percent efficiency with flood irrigation and 65 to 75 percent efficiency with the sprinkler system.

By increasing the diameter of pipe along some lines, the Capurros will also be able to operate a small hydraulic generator. For many years, the Capurros, like many ranchers in remote parts of Nevada, have been using a diesel generator to supply electricity for household use.

A small building houses two diesel generators near the three houses on the ranch. Herb Capurro said they mainly rely on the older generator he bought in 1954 and use the one purchased in 1974 as a backup power source. The older generator has one cylinder and uses two fly wheels. Capurro said it is the kind that was once used to power tugboats. It runs 700 revolutions per minute (rpm's) while most others run 1,000 to 3,600 rpm's.

The older generator is more reliable than the newer ones on the market, but it's difficult to find parts for and Capurro said he sometimes has to have parts made. Also it costs $12 to $15 a day for fuel, $360 to $450 a month, to run the one–cylinder generator.

If the Capurros can use their irrigation water to run a hydraulic generator, they will cut their power bill considerably.

Capurro said that the nearest power company electrical line is about 12 miles away. It would cost almost $500,000 to bring electricity in to the three houses from there, but only $15,000 for the hydroelectric plant, an investment that should pay for itself in about 3 years. Harry Knapp in California is designing the system.

The plan is to use a water wheel [illegible] water pressure from an irrigation [illegible] would power a generator wired to an [illegible] trical panel at the diesel generator bu[illegible]

The generator requires the water wheel to make 400 to 500 rpm's. To deliver the water pressure that can turn the wheel at that speed, it's critical that the proper sized nozzle be used. The system the Capurros are considering will produce 10 kilowatts of power, while the diesel generator is producing 6 to 7 kilowatts.

The water used to turn the water wheel and power the hydroelectric generator will be returned to irrigation lines for watering fields below the power plant.

According to Charlie Welch, an SCS soil conservation technician in Reno, another option the Capurros are considering is using an in-line hydraulic generator that wouldn't require a water wheel.

The Capurro family has been operating the Big Canyon Ranch since the 1940's. Living on the remote ranch high in the mountains has made the family self-reliant and resourceful. Switching the lights on at night is not something they take for granted.

Nancy M. Garlitz,
associate editor, *Soil and Water Conservation News*, SCS, Washington, DC

Far left, Richard MacDougall, SCS district conservationist (left), talks to Allen Capurro (center) and George Capurro about long-range management of their 2,600-acre ranch in western Nevada.
Near left, sprinklers run on gravity pressure from mountain springs.
Right, Herb Capurro inspects buckets on water wheel that may soon be used to generate electricity for domestic use on the Big Canyon Ranch.

SCS Develops Reservoir Operating Guides

Managing a reservoir in some Western States can be a juggling act for a reservoir operator. It seems that everybody wants water, but nobody wants too much. And the operator has no control over when and how much water will flow into the reservoir.

Most of the water comes as runoff in spring and early summer from melting snow in the mountains and rain. The amount of runoff each year is highly variable, but is almost always more than the reservoir can hold. Water must be stored and released later for some or all of the following uses: irrigation of agricultural land, production of hydroelectric power, consumption by cities and towns, and maintenance of fisheries, wildlife habitat, and recreation facilities. Downstream erosion and flooding must also be minimized.

Most operators have two basic tools to work with. The first is an outflow gate to regulate the release of water from the reservoir. The second is the streamflow predictions provided by the Soil Conservation Service and the National Weather Service. The challenge is to use the streamflow predictions to regulate the release of water at a rate that minimizes the uncontrolled spilling of excess water through the spillway channel, satisfies the demands of all water users downstream, and fills the reservoir by the end of the peak runoff season.

In a few States, SCS is developing individual operating guides to help reservoir managers to perform this task. In theory, these guides are similar to the conservation plans that SCS prepares for farmers. They are based on the concept that, to be applied effectively, natural resource data must first be interpreted for the specific situation.

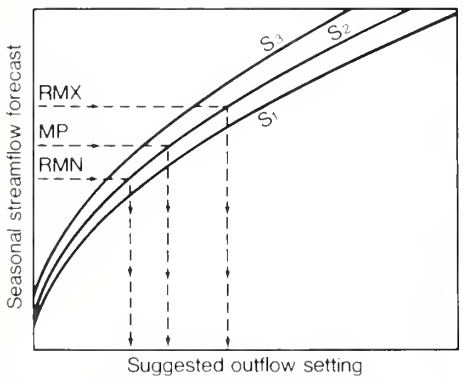
By using computer-generated rule curves on graphs, the guides advise the operator on what action to take in response to streamflow forecasts. First, the operator is provided with three runoff forecasts—most probable, reasonable minimum, and reasonable maximum. (See sample graph below left.) The operator locates these forecast values on the left-hand side of the graph and draws three lines horizontally to the specific rule curve corresponding to the volume of storage left to fill. From these three points on the rule curve, the operator then draws three lines down to the bottom of the graph to find a range of outflow rates from which to choose. Outflow settings selected in this manner allow the operator to fill the reservoir and maintain fairly constant release rates. The operator can also adjust the outflow as subsequent forecasts are received during the spring season or as local operating constraints change.

Without some sort of formal management plan, many operators simply fill their reservoirs as soon as possible in spring and send the rest of the runoff downstream. SCS is concerned because this "fill and spill" approach sometimes produces disastrous consequences. After they are full, reservoirs are unable to provide erosion or flood protection downstream.

One operating guide prepared by SCS in Montana is for Middle Creek Reservoir, south of Bozeman. This reservoir was built in 1951 by the construction of a dam on Hyalite Creek. It drains 27.4 square miles, has a useable capacity of 8,261 acre-feet, and has a maximum outflow of 800 cubic-feet per second (cfs). Elevation of the drainage area ranges from 6,722 feet above sea level at the dam to 10,299 feet at the highest mountain peak.

SCS prepared the operating guide in 1985 at the request of the Water Resources Division of the Montana Department of Natural Resources and Conservation (DNRC) and the Middle Creek Water Users Association (MCWUA). Approximately 80 members of MCWUA have about 110 contracts to buy water from the reservoir, which is operated and controlled by the association under agreement with Montana's

Reservoir Operations Planning Curve



In this simplified version, the curves S_1, S_2, and S_3 are for different capacities for additional water storage. The graph suggests an outflow setting for each of the three streamflow forecasts: reasonable maximum (RMX), most probable (MP), and reasonable minimum (RMN).

Hyalite Creek drainage area is the source of the melting snow which feeds Middle Creek Reservoir south of Bozeman, Mont.

Photo by Phil Farnes.

DNRC and USDA's Forest Service.

The guide gives top priority to satisfying all of the water contracts, which requires a minimum outflow of approximately 125 cfs. It recognizes that the best way to do this is to fill the reservoir during the peak runoff season and have it full going into the season of peak demand. Other objectives include keeping the wildlife habitat and fisheries vital downstream by maintaining a minimum streamflow of at least 25 cfs, reducing the risk of bank erosion and flood damage to roads by keeping outflow below 400 cfs, and ensuring that water storage doesn't dip below 2,750 acre-feet to sustain some 20,000 hours of sport fishing each year in the reservoir.

Melting winter snowpack and spring rain are the major sources of water for Middle Creek Reservoir. Snow survey data collected by SCS at seven locations in the drainage area provide accurate information on the amount of snowpack, but temperatures during snowmelt and spring precipitation must be predicted using probabilities based on previous years of data. There is an 80 percent likelihood that the runoff received will be between the forecasts for the reasonable maximum and reasonable minimum.

In low-snowpack years, streamflow drops rapidly after the snowpack has melted and there is little opportunity to increase the amount of water stored if precipitation is less than normal. In addition, water demands downstream are usually higher in low-snowpack years. In average-snowpack years, the streamflow holds up better because the snowpack takes longer to melt. Even if spring precipitation is lower than normal, some of the runoff can still be stored without affecting downstream uses. In high-snowpack years, the runoff usually holds up even if spring precipitation is lower than normal. The opportunity to increase storage lasts longer, and it's best to store much of the heavy snowmelt because long-duration, above-average flows downstream could cause extensive channel erosion.

Here is how the guide would work for a relatively normal year. March 1 streamflow forecasts indicate that the reservoir storage, which is a little under half full, is at a satisfactory level for the forecasted spring runoff. Outflow is allowed to fluctuate with the inflow.

New forecasts are received on April 1 and entered into the rule curves. As a result, outflow is adjusted to a fixed level while inflow rapidly increases with spring runoff. As the water level rises in the reservoir, the outflow remains relatively constant.

SCS specialists use data collected at remote snow survey stations, such as this one on Lick Creek south of Bozeman, to develop individual operating guides for reservoir managers.

Photo by Phil Farnes.

By May 15 the reservoir is nearly three-quarters full, and new forecasts suggest that outflow be increased to a rate still less than inflow. As additional snow survey data are received, the outflow is increased a little more on May 20 and again on June 5 as the storage approaches nine-tenths capacity.

On June 25, a remote snow survey station transmits information that indicates the snowpack has completely melted at the higher elevations in the drainage area. This means the runoff has peaked, and in another 3 days—with the reservoir full—the inflow is down equal to the outflow.

Irrigation begins downstream, and on July 1 the outflow is set higher than the inflow for the first time. Demands for irrigation water continue to increase into August while the inflow returns to its pre-spring-runoff level. In the second half of August, the demand for irrigation water abates and the reservoir enters the fall one-quarter full.

Although the reservoir ended the season with less water in storage than it had at the beginning of the year (one-quarter, compared to nearly one-half capacity), the operation was a success because two important goals were achieved. The reservoir was full—briefly—by the time the snowpack melted, and there was enough water for irrigation during the summer. By adjusting the outflow slightly lower than the inflow during the fall and winter, the storage can probably be restored to nearly half full before spring.

"Basically, we're just showing the operators how to use the data that we've been providing," said Phil Farnes, supervisor of the SCS Snow Survey Program for Montana. "It used to be that when we told the operators they were going to receive 50 percent more runoff than usual, some would know what to do about it and some wouldn't. The operating guides help them decide what to do, based on their unique situation. We're recognizing that just as there are no two farms exactly alike, there are no two reservoirs exactly alike."

Bernard A. Shafer,
data analysis group leader, Snow Survey Program, West National Technical Center, SCS, Portland, Oreg.

AgEvents

1986

March	16–22	National Wildlife Week
	20	National Agriculture Day
April	20–26	Keep America Beautiful Week
	22	National Arbor Day
May	1	International Land, Pasture, and Range Judging Contest
	4–11	Soil Stewardship Week
June	5	World Environment Day
September	21–27	National Farm Safety Week
	27	National Hunting and Fishing Day
October	5–11	National 4–H Week
	16	World Food Day
November	21–27	National Farm City Week

New Publications

Agriculture: Foundations, Principles, and Development

by J. R. Raeburn

With this book, the author attempts to provide an overall picture of agriculture that is useful as an introduction and as a general guide and reference. The introduction reviews nine questions that are central to the world's problems with agriculture. The author answers such questions as what does agriculture contribute to human welfare and what are the obstacles to future increases in foodstuff production?

The book is divided into 6 parts with a total of 23 chapters. Most chapters conclude with sections on references used, further readings, and questions and exercises the reader can complete.

Copies of this 329-page book are available for $29.95 from John Wiley & Sons, Inc., One Wiley Drive, Somerset, N.J. 08873.

Ecological Interactions in the Soil Environment: Plants, Microbes, and Animals

Edited by A. H. Fitter
with D. Atkinson, D. J. Read, and M. B. Usher

This volume contains papers presented at a British Ecological Society meeting held in April 1984. The meeting brought together researchers on all aspects of the soil biota, from the roots through the various microbial groups to the soil fauna.

The chapters in the book are arranged in progression from studies on roots alone, to root-microbial, animal-microbial, and finally to more complex interactions.

Copies of this 451-page book are available for $57 from Blackwell Scientific Publications, Inc., P.O. Box 50009, Palo Alto, Calif. 94303.

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Minnesota: Redwood County.
Montana: Roosevelt and Daniels Counties.
Nevada: Las Vegas and Clark Counties.
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